Findings Report

For

POST Phase 1: Requirements Definition
Requirements Management

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1 Introduction

The Systems Integration Division (SID) Management Steering Council (MSC) has enacted several Process Action Teams (PATs), which are made up of a cross-section of duty experts throughout SID. These PATs meet for a defined period of time for the purpose of improving the processes and practices within SID and enabling the organization toward an on-going journey of using common standards and industry best practices. The PATs are the primary vehicle for providing the contents that make up the SID Best Practice website.

1.1 Purpose Of This Findings Report

THIS REPORT IS ONE OF AN ONGOING SERIES OF REPORTS THAT SUMMARIZE THE FINDINGS AND RECOMMENDATIONS OF THE PAT FOCUSING ON DERIVING THE REQUIREMENTS FOR AN ENTERPRISE-WIDE INFORMATION MANAGEMENT TOOL REFERRED TO AS THE PROJECT OFFICE SUPPORT TOOL (POST). THERE ARE CURRENTLY TEN MODULES PLANNED FOR THE POST AS DEPICTED IN

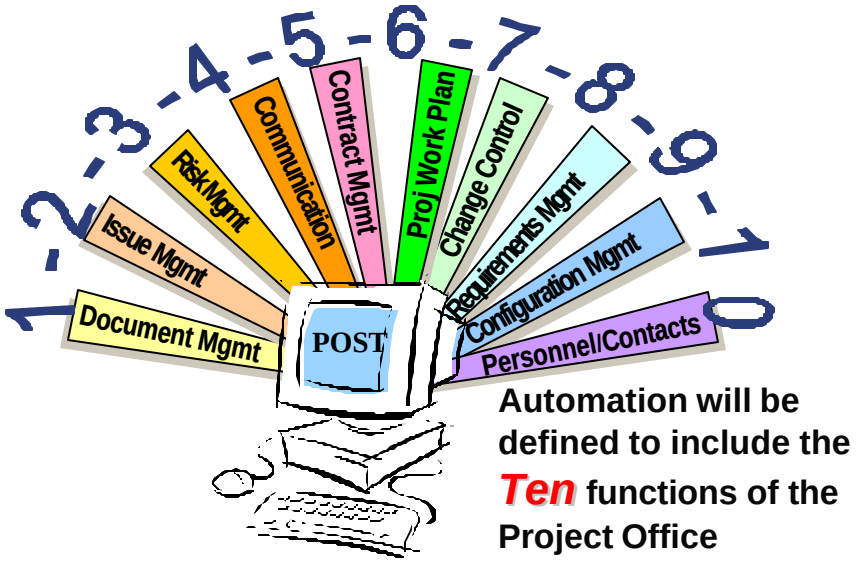

Figure 1 below: Issues/Actions Management, Document Management, Risk Management, Change Control, Configuration Management (of county sites), Workplan, Contract Administration/Tracking, Contacts Management, Communication Management, and Requirements Management.

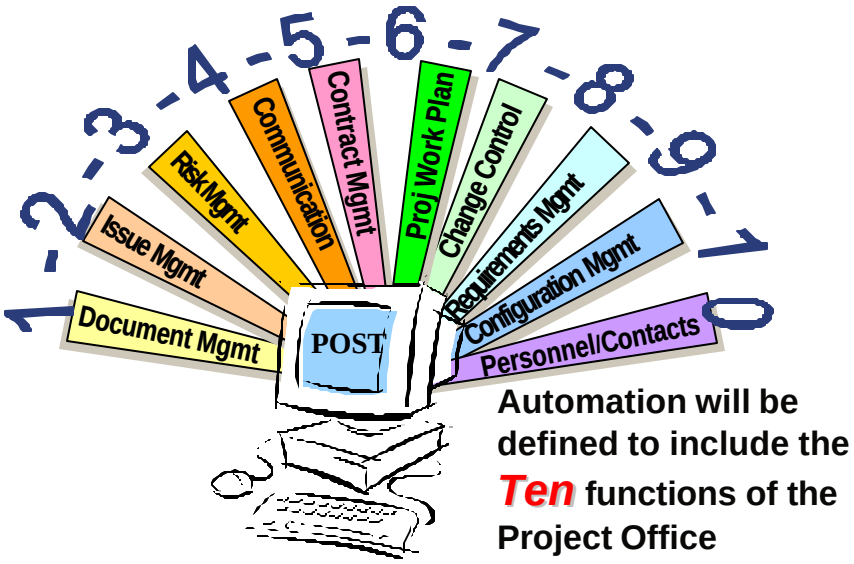

FIGURE 1: THE TEN MODULES OF POST

This report is the seventh of the POST PAT series and addresses the Requirements Management module only. The results of this PAT are also posted on the Best Practices website and represent the Requirements Document for the POST Phase 2- Proof-Of-Concept for Requirements Management. (Note: Reference the POST Project Charter for more detail on the POST Project.)

The Requirements Management function interacts primarily with the Change Control function, but is also affected by several other project functions. Figure 2 depicts the interactions between the ten modules of POST.

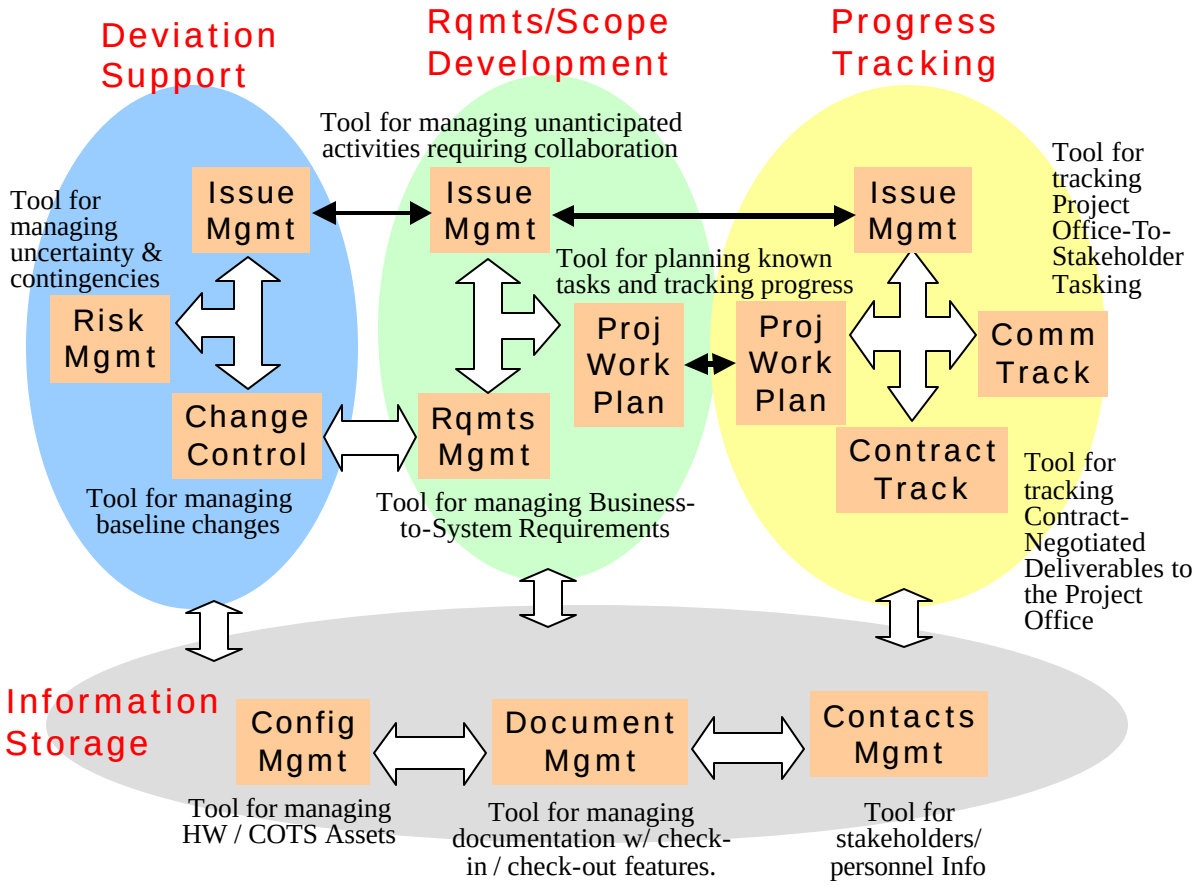

Figure 2. Relationship between POST Modules

1.2 Purpose Of Requirements Management

Requirements Management consists of the processes that focus on maintaining identification and traceability of business requirements to the point where they are incorporated initially into the proposal for contractor implementation and throughout the System Development Life Cycle. Requirements Management is the place where the end item product is clearly articulated and defined. The automation of this process using a tool will allow the decomposition of requirements, traceability and tracking of changes to requirements so that nothing gets missed or modified unknowingly.

There are three components of requirements management:

- Requirements Development
- Managing Changes to Requirements (in coordination with the Change Control Process)
- Managing Requirements Traceability

This PAT focused on the latter two elements. Requirements Development is briefly discussed here for completeness, however techniques and tools for deriving and validating requirements will be discussed in a future PAT.

2 Findings

2.1 Common Terms and Definitions

Baseline	A specification that has been formally reviewed and agreed upon, that thereafter serves as the basis for further development, and can be changed only through formal change control procedures.
Bi-directional Traceability	Traceability both to a source document(s) (backwards traceability) and to subsequent work products where the requirements are implemented (forwards traceability).
Requirement	A condition or capability needed by a user to solve a problem or achieve an objective.
Requirements Management	The process of controlling the content and scope of a system through its requirements. Includes creation and managing of the baseline, change and version control, and traceability of requirements to source documents and work products where the requirements are implemented.
Requirements Tags	An identifier for a requirement that assists with categorizing and linking requirements, usually consisting of a prefix and number scheme (e.g., Impl.Cnty.1, CM.1.a.2). Requirements tags signify relationships, such as parent-child, but not traceability.
Source	The document or organization which requested a requirement, such as legislation, regulation, policy or user request.
Traceability	A relationship established between two or more products of the development process, especially having a predecessor-successor or master-subordinate relationship (e.g., legislation to requirement, and report to report fields).
Voided Requirement	A requirement that was proposed, but not included in the baseline. In most cases, these requirements and the rationale for their voiding should be tracked for historical purposes. Same as cancelled or deleted.

2.2 Acronyms

ASCII	American Standard Code for Information Interchange
CCB	Change Control Board
CDSS	California Department of Social Services
ConOps	Concept of Operations
CR	Change Request
HTML	Hyper Text Markup Language
IEEE	Institute for Electrical and Electronics Engineers
IV&V	Independent Verification and Validation
M&O	Maintenance and Operations
MS	Microsoft
ODBC	Open Database Connectivity
OLE	Object Linking and Embedding
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
QA	Quality Assurance
RFP	Request for Proposal
RM/E	Requirements Manager/Engineer
SA-CMM	Software Acquisition Capability Maturity Model
SEI	Software Engineering Institute

SID	Systems Integration Division
SRS	Software Requirements Specification
SysRS	Systems Requirements Specification
WBS	Work Breakdown Structure
WYSIWYG	What You See Is What You Get

2.3 Requirements Management Process

Figure 3 depicts the requirements management high-level process.

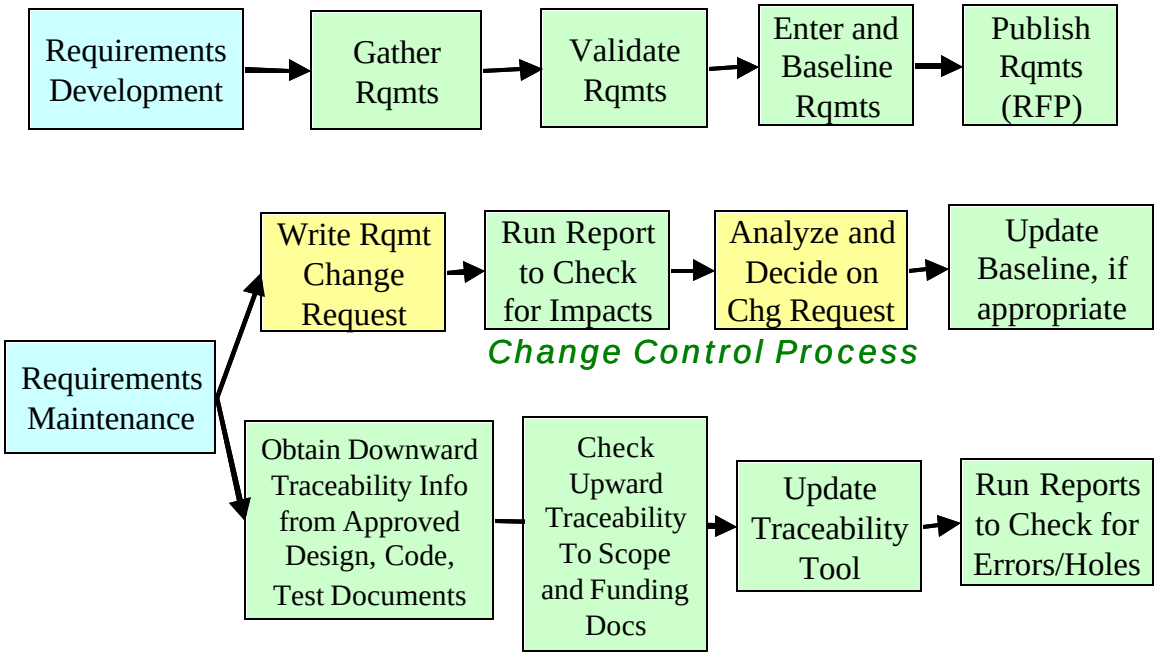

Figure 3. Requirements Management Process

2.3.1 Requirements Development Considerations

Requirements Development encompasses the identification, validation and initial baselining of requirements. This is usually followed by the publishing of the requirements in an RFP and a subsequent re-baselining of requirements, due to comments and clarifications during reviews.

In most cases, it has been the projects' responsibility to derive the business requirements from the Sponsor, Subject Matter Experts and Users via policy, regulation and other documents, and meetings and workgroups. The Sponsor does not usually have a firm list of business requirements in any one place prior to the initiation of the project. Figure 4 depicts the hierarchy of requirements and how the project's system requirements are derived from various sources.

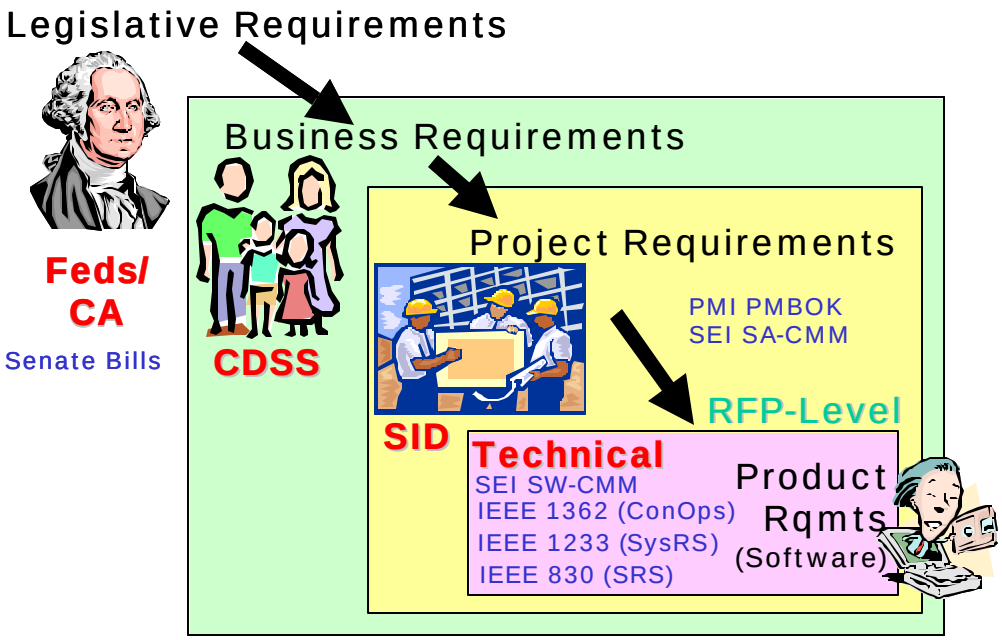

Figure 4. Hierarchy of Requirements

The vendor is usually responsible for managing the software product requirements, but must be able to show traceability to the project (RFP-level) requirements. The project sometimes retains approval of the vendor's requirements management tool, if the tool is not dictated by the project.

Project requirements include contractual requirements, and in some cases, Statement of Work items as well. Usually it is the project QA or IV&V staff that are responsible for managing the requirements and monitoring traceability to design, code and test items.

2.3.2 Requirements Change Control Considerations

The Requirements Management Process must work closely with the Change Control Process. Usually anyone (Sponsor, Stakeholder, User, Project Staff) can propose a change to the requirements, however it is important that these groups understand the possible impacts of a requirements change, such as impacts to the project schedule, cost and re-work (due to document updates). In many cases (especially in the M&O world), new requirements from the users may mean giving up other planned changes due to limited funds. When planning and budgeting for future years, the project must try to predict and request sufficient funds for changes and money for the contractor to perform analysis of proposed changes. Projects are encouraged to include their stakeholders in long-term planning sessions.

Another consideration when budgeting for change requests is the amount of vendor involvement in the change request analysis and how soon to involve the vendor. If there is limited money for vendor participation, the project may elect to review and approve requirements change requests without vendor participation, and then to have the vendor perform the analysis, design and costing so that the vendor only analyzes requests that the project is truly interested in pursuing. After the design and costs have been approved, the project may prioritize the implementation based on available funds and schedule. If the project knows that there are pending requirements, it may be prudent to build into the contract a specific dollar amount for change request analysis.

The Requirements Manager/Engineer (RM/E) should receive copies of all change requests, and should query the requirements tool to identify affected areas (if the requirements already exist), or possible related areas (if the requirements are new) based on affected functionality. The RM/E should analyze the affected requirements to determine if other requirements or other system areas (based on the requirements) may be affected. The results of the analysis should be forwarded to the change request analyst for inclusion in their reports. The RM/E may attend the Configuration/Change Control Board (CCB) meeting, or may simply receive the outputs and decisions from the Board.

If a large number of changes are proposed or the impact to the system is significant, the CCB should also consider whether to re-baseline the requirements. Some of the considerations for re-baselining include:

- Cost of changes
- Scope of changes
- Number of affected areas
- Impacts to the schedule

2.3.3 Requirements Traceability Considerations

In most cases the RM/E is included in reviews of the contractor work products (design, code, test). The RM/E should review the traceability information provided by the vendor with the work product, and may enter the information to the tool (or a working area of the tool). This allows the RM/E to run reports on traceability and to identify holes or problems with traceability prior to approval of the work product. If errors in traceability are found after the work product has been approved, the problems should be addressed through a change request or issue/action item (depending on the type of work product).

Most projects are tracing to the following work products:

- Requirements Statement
- Design Document Section/Paragraph Number (General System Design and Detailed System Design, if both are delivered)
- Code Module/Function (if custom software is being delivered)
- System Test Procedure/Script
- Acceptance Test Procedure/Script

If the project staff will be maintaining the custom software, then traceability may also be required to the unit and integration/module test procedures/scripts as well.

2.4 Requirements For a Requirements Management Tool

The requirements for a requirements management tool are contained in Appendix A. The priority of the requirement (High, Medium, Low) is listed in parentheses after each requirement.

2.4.1 Required Data Elements

Appendix B lists the types of data elements that should be captured by the requirements management tool.

2.4.2 Reports

Appendix C lists the types of reports (in addition to ad-hoc reports) that should be available from the requirements management tool.

2.4.3 Automated Notifications

Automated notifications are briefly discussed in the requirements in Appendix A. The specific desired notifications are listed below.

- Notify functional manager when requirements in their area have been modified or when a request has been proposed in their area
- Notify requirements manager when a change request is received

3 Recommendations For POST Phase 2: Proof-Of-Concept Phase

3.1 Define Suite of Tools for Requirements Mgmt

The Phase 2 PAT will focus on the prototype of a tool to aid projects in establishing requirements management and tracking. Rational's RequisitePro tool is currently in use by some of the projects and will serve as the basis of the prototype evaluation.

Appendix A – Requirements

I. Requirements Development

a. The tool shall be able to specify database fields to be used in requirements definition. (High)
b. The tool shall support non-textual formats by storing and editing the requirements in the specified format such as bit-mapped graphics, vector graphics, tables, equations, or formal logic notation. (Low)
c. The tool shall be able to store and edit non-requirement items in the same manner as requirements items of the same format and be able to associate them with requirements. (Medium)
d. The tool shall support manual entry of requirements. (High)
    i) The tool shall be capable of storing and editing the full text of requirement statements via basic word processor functions. (High)
    ii) The tool shall have a spell-checking function. (Medium)
    iii) The tool shall ensure data integrity through methods like lookup tables, menus, filters, and cross-checks. (High)
e. The tool shall be able to parse and import requirements from source documents in formats including the MS Office suite (including MS Access), ASCII and HTML. (High)
f. The tool shall be able to import requirements from other tools using text-delimited files. (High)
g. The tools shall be capable of maintaining links to external documents to facilitate requirements maintenance (i.e., when changes are made to an external document you should not need to re-create a link from the requirement to the document). (High)
h. The tool shall provide a means to unambiguously identify every requirement. (High)
    i) The user shall be able to define the identification scheme. (Medium)
    ii) The user shall be able to redefine the identification labels of existing requirements. (Low)
i. The tool shall be able to identify the hierarchy of requirements. (High)
    i) The tool shall be capable of displaying all the lower level (child) requirements associated with a given requirement. (High)
    ii) The tool shall be capable of displaying graphically the hierarchy and support assigning and changing the hierarchy graphically. (Low)

II. Requirements Analysis

a. The tools shall support user definition of custom categories/attributes to categorize and prioritize requirements. (High)
    i) The tool shall allow user customizable attributes in pulldown menus. (High)
    ii) The tool shall be able to add and update category and priority information even after the requirement has been entered into the tool. (High)
b. The tool shall be able to perform adhoc queries on requirements. (High)

III. Requirements Traceability

a. The tool shall be able to identify a requirement source. (High)
    i) The tool shall provide reference information and be able to link to use cases. (Low)
b. The tool shall be able to trace requirements to the Contractor's requirements, design, and test documents. (High)
c. The tool shall be able to accept traceability data from the Contractor's requirements management tool. (Medium)
d. The tool shall link traceability and verification information to the appropriate requirements. (High)
e. The tool shall record actual verification results, if available. (Medium)
f. The tool shall identify untraced and unverified requirements. (High)

IV. Requirements Configuration Management

a. The tool shall be able to baseline and re-baseline requirements. (High)
b. The tool shall be able to add and update requirements. (High)
    i) The tool shall be able to input pending requirements along with comments. (High)
    ii) The tool shall track the status of all pending requirements. (High)
    iii) The tool shall output reports to support the approval process. (High)
    iv) The tool shall be able to record the resolution of proposed requirements. (High)
    v) When changing an existing requirement, the tool shall identify all the lower level (child) requirements affected by the requirement. (High)
    vi) The tool shall be able to setup and save groups of pending changes and then to enable the groups as certain circumstances or status changes, such as acceptance or approval of changes. (Low)
    vii) The tool shall provide requirement version identification, such as by revision number/letter, date and time, and other criteria. (High)
    viii) The tool shall provide a means to unambiguously identify the version of groups of requirements, such as by revision letter/number, date, and other criteria. (Medium)
    ix) When a source document is updated, be able to parse the input specifications, comparing the document with the previously imported version, and marking likely new requirements. (High)
c. The tool shall be able to track requirements status. (High)
    i) The tool shall provide the entire requirement history (who, what, where, when and how of the change(s)). (High)

V. Communication

a. The tool shall be able to link to an e-mail system to allow for notifications and discussions about requirements and changes. (High)

VI. Requirements Outputs

a. The tool shall support the generation of System Requirements Specifications (SyRS) in MS Word format following a modified IEEE 830 structure. (High)
    i) The tool shall automatically generate applicable document lists, acronyms lists, test methods cross-reference tables, and requirements source tables. (Medium)
    ii) The tool shall ensure the document and requirements tool database stay synchronized. (High)
b. The tool shall be able to produce status reports on the state of stored requirements based on a specified period. (High)
    i) The tool shall produce metrics such as (High)
        (a) Number of requirements by category
        (b) Number of approved requirements
        (c) Number of requirements change requests
        (d) Number of pending requirements
    ii) The tool shall produce status reports for configuration management. (High)
c. The tool shall support generation of adhoc reports. (High)
d. The tool shall be able to output reports or report data in MS Office format and ODBC-compliant format. (High)
e. The tool shall allow for WYSIWYG previews of finished outputs. (Medium)

VII. Requirements Re-use

a. The tool shall store common requirements in a central location. (Medium)
    i) The tool shall be able to export the common requirements to other projects. (Medium)
b. The tool shall be able to support multiple project requirements. (Medium)

VIII. Compatibility With Other Tools

a. The tool shall support OLE copy and paste functions. (High)
b. The tool shall store the requirements data in an ODBC compliant database. (High)
c. Where possible, the tool shall provide an interface or be able to link to other tools in use in the project office, particularly (High)
    i) Document Management tool,
    ii) Change Request Tracking tool,
    iii) Configuration Management tool,
    iv) Issue Tracking tool, and
    v) Work Planning tool.

IX. Tool Administration

a. The tool shall support controlled access. (High)
b. The tool shall allow different types of access based on the type of user. (High)
    i) The tool shall be capable of restricting change authority for selected requirements to a specific group or set of users. For instance, administrator with full privileges, general user with read/write capability, and reviewer with read-only on requirements and write privileges for comments. (High)

X. User Interface

a. The tool shall have an intuitive user interface. (High)
b. The tool shall allow customization of the user interface based on security access and project role. (Medium)

XI. System Environment

a. The tool shall be accessible from a user's desk via their desktop computer (i.e., should not have to go to a server room to access tool). (High)
b. The tool should be compatible with the project's latest version of Windows (currently Windows 2000). (High)
    i) The tool shall be scalable to support different sizes of projects. (High)
    ii) The tool should be able to operate on a desktop computer with a single user, as well as operate from a file server with up to 10 concurrent users. (High)
c. The tool shall be simple to install. (High)
d. The tool's architecture should be compatible with the division's current architectures. (High)
e. The tool should store data in an ODBC compliant database. (High)

XII. Miscellaneous

a. The tool should support open database standards. (High)
b. The tool should support scripting. (Medium)
c. The tool should have a thin client or zero client, and allow for full access to data via a browser through the intranet or internet. (Low)
d. The tool should have a thin client or zero client, and allow for read-only access to data via a browser through the intranet or internet. (High)

XIII. Vendor Support

a. The vendor should offer training courses. (High)
b. The recommended basic training should not exceed 5 days. (Medium)
c. The user documentation should be easy to use. (High)
    i) The tool should provide on-line, context sensitive help. (Medium)
d. The vendor should provide customer and technical support. (High)

Appendix B – Desired Data Elements

The following table describes the data elements currently found in various SID systems and reports. This is not meant to dictate database structure or field definitions. Many of the data elements are expected to be cross-references or links to other project office tools and may actually be stored in a common database or file.

#	Title	Description
1.	Requirement Tag or Number	Usually a prefix and a number
2.	Date of Requirement Approval	Baseline date, or change request date
3.	Priority	Critical/Desired or High/Medium/Low
4.	Status	Unallocated, Allocated, Designed, Completed, Accepted
5.	Text	Exact text of the requirement
6.	Compliance	Unknown, Full, Partial, None,
7.	Type of Requirement	System, Component, Process, Workplan, Deliverable, etc. (should be customizable by each project)
8.	Allocated To	(can be multiple) Part of system, name of component/process, WBS #, deliverable name, etc.
9.	Source Type	(can be multiple) Legislation, Regulation, Policy, User Request, Fed Requirement
10.	Source Reference	(can be multiple) Applicable paragraph number/name, page, date/subject of policy letter, etc.
11.	RFP Section	(can be multiple) RFP paragraph number/name, date of RFP/RFP addendum
12.	Proposal Section	(can be multiple) Proposal paragraph number/name, date of Proposal
13.	Contractor Response from Proposal	Summary of proposal response to this requirement
14.	Contract Provision/Paragraph	(can be multiple) Any clarification, or additional information
15.	Contractor	If multiple vendors involved, who has responsibility
16.	Verification Method	Test, Code Inspection, Review of Documentation, Vendor Certification
17.	Design Reference	(can be multiple) Design paragraph name or number, date of design doc
18.	Code Reference	(can be multiple) Code module name or number, and file name, code version number
19.	System Test Reference	(can be multiple) Test script/procedure name or number, date of system test docs
20.	Acceptance Test Reference	(can be multiple) Test script/procedure name or number, date of acceptance test docs
21.	Comments	Free text for history or context
22.	Version/History Info	
23.	Change Requests associated with the requirement	(can be multiple) CR #, date of approval, title, status
24.	Workplan Tasks associated with the requirement	(can be multiple) WBS #, title, status, project file name
25.	Issues associated with the requirement	(can be multiple) Issue #, date, title, status

Appendix C – Standard Reports

#	Title	Description
A.	All Open (unsatisfied) Requirements	Reqmts which have not be satisfied yet, or are only partially satisfied
B.	All Closed (satisfied) Requirements	Reqmts which have been satisfied and verified
C.	Operational Requirements List	All operational requirements
D.	Contract Requirements List	All contract requirements
E.	Metrics and Statistics	Metrics and Statistics for tracking requirements stability and status (total reqmts, # open, # closed, # of pending CRs, etc.)
F.	Rqmts by Topic/Type	Reqmts by topic or type or system area
G.	System Requirements	All system requirements
H.	System Requirements Allocation	Reqmts allocated to each system area
I.	System Component Allocation	Reqmts allocated to each system component
J.	System Requirements Verification	Test reqmts (scripts and procedures) associated with each system reqmt
K.	System Component Verification	Test reqmts (scripts and procedures) associated with each system component
L.	Test Requirements Summary	System reqmts and component verified by each test reqmt
M.	Deliverable Reqmts	Requirements allocated to deliverables, sorted by deliverable
N.	Workplan Reqmts	Requirements allocated to workplan tasks
O.	Contract Reqmts Schedule	Workplan tasks allocated to the contract, sorted by contract paragraph/heading
P.	Component Schedule	Workplan tasks associated with system components
Q.	Change Summary	Changes for a specific baseline or against a specific requirement
R.	Change Impact Report	Possible impacts associated with a reqmts change/failure
S.	Component Impact Report	Possible impacts associated with a component chg/failure
T.	Voided/Cancelled Requirements Report	All requirements that were voided or cancelled, the date of cancellation, and rationale.